

A WHEEL BEARING AND A BEARING APPARATUS FOR  
A WHEEL OF VEHICLE OF THE SEMI-FLOATING TYPE  
HAVING THE WHEEL BEARING

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a National Stage of International Application No. PCT/JP2004/017917, filed December 2, 2004, which claims priority to Japanese Patent Application No. 2003-411307, filed December 10, 2003 and Japanese Patent Application No. 2004-273178, filed September 21, 2004. The disclosures of the above applications are incorporated herein by reference

FIELD

~~[-0001]-~~

[0002] The present ~~invention~~disclosure relates to a vehicle wheel bearing apparatus ~~for a wheel of vehicle for to~~ rotatably ~~supporting~~support the wheel relative to a suspension apparatus of the vehicle, and, more particularly, to a wheel bearing ~~wherein which~~ a driving wheel is supported by a double row rolling bearing and a vehicle bearing apparatus for a wheel of vehicle of of a semi-floating type having the wheel bearing.

BACKGROUND

~~[-0002]-~~

[0003] In a vehicle such as a truck, ~~which has~~having a body of a frame ~~structure~~construction, an axle structure of a driving wheel of a full-floating type has been widely adopted. In ~~a recent driving wheel supporting structure, there has been~~ widely ~~adopted~~adopted a unit structure of a double row rolling bearing has been widely adopted so as to improve the readiness of assembly, reduction of weight and size.

One example of such a prior art vehicle wheel bearing apparatus for a wheel of vehicle of the prior art is shown in Fig. 4.

~~—[0003]—~~

**[0004]** In this vehicle wheel bearing apparatus for a wheel of vehicle, a driving drive shaft 52, connected to a differential apparatus (not shown), is inserted into an axle housing 51. A and a double row conical roller bearing 53 is mounted on the axle housing 51. A hub wheel wheel hub 54, rotatably supported by the double row conical roller bearing 53, is connected to a flange 56, via hub bolts 55. A pair of inner rings 57 are is connected to each other by a connecting ring 58. The rings 57 are and fitted fit onto the end of the axle housing 51 and then securely fastened by a fastening nut 59. On the other hand, an outer ring 60, of the double row conical roller bearing, is fitted fit into the hub wheel wheel hub 54. The outer ring 60 is and axially secured with its both its ends being sandwiched by the flange 56 of the driving drive shaft 52 and a brake rotor 61. A double Double row conical rollers 62 are rollably contained by cages 63 between the annular space between the inner and outer rings 57 and 60, and seals Seals 64 are arranged at both ends of the annular space to seal off the inside of the wheel bearing off from the outside.

~~—[0004]—~~

**[0005]** The inboard side end of the inner ring 57 is formed with an annular stepped portion 65. A on which a seal ring 66 is mounted on the stepped portion 65. An annular recess 67 is formed on the outer circumferential surfaces at mutually abutted abutting portions of the pair of inner rings 57. A and a seal ring 68, of an elastic material member, is fitted therein into the recess 67. These The seal rings 66

and 68 prevent penetration or ingress of rain water or dusts into the axle housing 51, leakage of differential gear oil to outside and ingress of the differential gear oil into the inside of the bearing (see Japanese Laid-open Patent publication No. 99172/2001).

#### ~~Disclosure of the Invention~~

#### ~~Problems to be solved by the Invention~~

~~—[0005]—~~

[0006] However, since the prior art vehicle wheel bearing apparatus for a ~~wheel of vehicle of the prior art~~ has a structure so such that the double row of conical roller bearing 53 is arranged between the ~~hub wheel~~ wheel hub 54 and the axle housing 51, and that the driving drive shaft 52 is inserted into the axle housing 51, and then the flange 56 of the driving drive shaft 52 is connected to the ~~hub wheel~~ wheel hub 54 by the hub bolts 55, a reduction of the weight and size of the bearing apparatus is limited. Also, ~~as well as assembly of the bearing apparatus is complicated~~ due to by requirement of a large number of structural parts.

#### ~~SUMMARY OF THE INVENTION~~

~~—[0006]—~~

[0007] It is therefore an object of the present ~~invention~~ disclosure to provide a vehicle wheel bearing apparatus for a ~~wheel of vehicle~~ which can reduce the weight, size and a number of parts. Also, the bearing apparatus and ~~also can prevent~~ prevents ingress of rain water or dusts and leakage of differential gear oil.

~~—[0007]—~~

[0008] ~~—For achieving the object, there is provided, according to the~~ The present invention ~~disclosure provides a vehicle wheel of claim 1, a bearing apparatus for a wheel of vehicle structured as a unit of a hub wheel~~ wheel hub and a double row

rolling bearing ~~which comprises~~comprising an inner member ~~including~~with a hub ~~wheel~~wheel hub integrally formed with a wheel mounting flange on its one end. ~~with a wheel mounting flange and~~A serration is formed on its inner circumferential surface of the ~~wheel hub~~. ~~with a serration and having an~~An axially extending cylindrical portion is formed with the flange. One or more ~~and inner~~inner rings are press-fittedfit onto the cylindrical portion of the ~~hub wheel~~wheel hub. At least one of inner raceway surfaces is ~~and~~ formed on which an outer circumferential surface of the inner rings. ~~with at least one of inner raceway surfaces; an~~An outer member is arranged around the inner member. The outer member includes ~~and formed with~~ double row outer raceway surfaces on its inner circumferential surface ~~oppositely~~opposite to the inner raceway surfaces; ~~Double~~double row rolling elements are arranged between the inner and outer raceway surfaces of the inner member and the outer member; A ~~a~~ cage ~~for freely rollably holding~~holds the rolling elements; Seals ~~and seals for sealing~~seal an annular space between the inner member and the outer member. A ~~characterized in that a~~ partition wall is integrally formed on the ~~hub wheel~~wheel hub at its outboard side ~~to for closing~~close a central bore of the ~~hub wheel~~wheel hub.

~~[0008]~~

[0009] ~~According to the present invention of claim 1, since~~Since the partition wall is integrally formed on the ~~hub wheel~~wheel hub at its outboard side ~~for closing to~~close a central bore of the ~~hub wheel~~wheel hub, the rigidity of the ~~hub wheel~~wheel hub is increased. Thus, ~~and thus~~ it is possible to suppress the elastic deformation of the ~~hub wheel~~wheel hub and to improve the durability of the bearing apparatus.

~~—[0009]—~~

~~[0010]~~ According to the present invention of claim 2, since Since said at least one of the inner raceway surfaces is formed directly on the outer circumferential surface of the ~~hub-wheel~~wheel hub, it is possible to further reduce the ~~weight and size and weight~~ and increase the rigidity of the bearing.

~~—[0010]—~~

~~[0011]~~ According to the present invention of claim 3, since Since the end of ~~said~~the cylindrical portion is plastically deformed radially outward to form a caulked portion ~~for to preventing~~prevent the inner ring from ~~being slipped~~slipping off ~~off from~~ the cylindrical portion of the ~~hub-wheel~~wheel hub, it is unnecessary to control the amount of preload of the bearing as in the prior art by tightly fastening the inner ring using a nut. Thus, ease~~ease~~ness of assembly of the bearing apparatus to a vehicle can be improved. Also, ~~and the~~ predetermined amount of preload can be kept for a long term. In addition, it is possible to substantially reduce the number of parts and to reduce ~~the manufacturing cost, and the weight and size of the bearing due to the improvement in~~ the ease~~ease~~ness of ~~assemble~~assembly.

~~—[0011]—~~

~~[0012]~~ Preferably according to the present invention of claim 4, since Since the outer circumferential region of the wheel mounting flange, from its inboard side base ~~of inboard side~~ to the cylindrical portion, is hardened by high frequency induction hardening ~~as having the~~to have a surface hardness of 58~64 HRC, and since the caulked portion ~~is remained~~remains unhardened ~~as having to have a the~~ surface hardness of 25 HRC or less after forging, it is possible to improve the

durability of the ~~hub wheel~~wheel hub and the workability of the caulked portion during its plastic deformation. Thus, this improves ~~and thus the~~ reliability ~~of~~and quality of the bearing.

~~—[0012]—~~

[0013] ~~According to the present invention of claim 5, since~~Since a the vehicle wheel bearing apparatus for ~~a wheel of vehicle of~~ the a semi-floating type ~~comprising~~comprises an axle housing supported under a body of a vehicle; a hollow ~~driving~~drive shaft inserted into the axle housing; ~~and the vehicle wheel bearing apparatus for a wheel of vehicle of any one of claims 1~4 arranged between the driving~~drive shaft and an opening of the axle housing; ~~and the driven~~driving shaft connected to the~~said~~ inner member so that ~~a~~ torque is transmittable ~~therebetween,~~between the two, it is possible to provide a vehicle wheel bearing apparatus for ~~a wheel of vehicle of~~ the semi-floating type which has a high rigidity and can reduce the weight and size ~~and also of the gearing apparatus. Also, this can prevent the leakage of differential gear oil to the outside as well as the ingress of rain water or dusts from the outside into the differential gear oil through the driving shaft.~~

~~—[0013]—~~

[0014] ~~—According to the present invention of claim 6, since~~Since the ~~driving~~drive shaft is separably connected to the inner member via the serration, the workability of assembly of the bearing apparatus can be remarkably improved.

~~Effect of the Invention~~

~~—[0014]—~~

[0015] According to the present vehicle wheel bearing apparatus ~~for a wheel of vehicle of the present invention,~~ since the vehicle wheel bearing apparatus ~~for a~~

~~wheel of vehicle~~ is structured as a unit of a ~~hub wheel~~wheel hub and a double row rolling bearing ~~comprises~~comprising an inner member ~~with~~including a ~~hub wheel~~wheel hub integrally formed with a wheel mounting flange on its one end ~~with a wheel mounting flange and on~~with its inner circumferential surface ~~including~~with a serration and having an axially extending cylindrical portion ~~with~~and one or more inner rings ~~press-fitted~~fit onto the cylindrical portion of the ~~hub wheel~~wheel hub and with the inner rings formed with at least one of inner raceway surfaces on which its outer circumferential surface; ~~with at least one of inner raceway surfaces~~; an outer member arranged around the inner member and formed with double row outer raceway surfaces on its inner circumferential surface ~~oppositely~~opposite to the inner raceway surfaces; double row rolling elements arranged between the inner and outer raceway surfaces of the inner member and the outer member; a cage ~~for~~freely rollably holding the rolling elements ~~(5)~~; ~~and seals for sealing an annular space between the inner member and the outer member; and is characterized in that a partition wall is integrally formed on the hub wheel~~wheel hub at its outboard side ~~for to close~~closing off a central bore of the ~~hub wheel~~wheel hub, the rigidity of the ~~hub wheel~~wheel hub is increased and thus it is possible to suppress the elastic deformation of the ~~hub wheel~~wheel hub and to improve the durability of the bearing apparatus.

~~[0015]~~

**[0016]** In addition, according to the present vehicle wheel bearing apparatus ~~for a wheel of vehicle of the present invention~~, since a vehicle wheel bearing apparatus ~~for a wheel of vehicle~~is of a semi-floating type comprising an axle housing

supported under a body of vehicle; a hollow driving shaft inserted into the axle housing; and the vehicle wheel bearing apparatus for a wheel of vehicle of any one of claims 1-4 is arranged between the drivingdrive shaft and an opening of the axle housing; and the drivingdrive shaft is connected to thesaid inner member so that a torque is transmittable ~~therebetween~~ between the two, it is possible to provide a vehicle wheel bearing apparatus for a wheel of vehicle of the semi-floating type which has a high rigidity and can reduce the weight and size. Also, it prevents and also can prevent the leakage of differential gear oil to the outside as well as the ingress of rain water or dusts from the outside into the differential gear oil through the drivingdrive shaft.

~~Best mode for carrying out the Invention~~

~~[0016]~~

[0017] According to the present invention, there is provided a A vehicle wheel bearing apparatus is for a wheel of vehicle structured as a unit of a hub wheelwheel hub and a double row rolling bearing comprisingwhich comprises an inner member includingwith a hub wheelwheel hub integrally formed with a wheel mounting flange on its one end. with a wheel mounting flange A serration is formed and on its inner circumferential surface of the wheel hub. Also, with a serration and having an axially extending cylindrical portion is formed with the flange. One or more i and inner nner rings are press-fittedfit onto the cylindrical portion of the hub wheelwheel hub. At least one inner raceway surface is and formed on anwhich outer circumferential surface of the inner rings. An with at least one of inner raceway surfaces; an outer member is arranged around the inner member and formed with double row outer raceway surfaces on its inner circumferential surface oppositelyopposite to the inner



raceway surfaces; ~~Double~~ double row rolling elements are arranged between the inner and outer raceway surfaces of the inner member and the outer member. A; a cage ~~for~~ freely rollably holding holds the rolling elements. Seals seal; ~~and seals for sealing~~ an annular space between the inner member and the outer member. A; characterized in that a partition wall is integrally formed on the ~~hub wheel~~ wheel hub at its outboard side ~~for closing~~ to close a central bore of the ~~hub wheel~~ wheel hub.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0018]** Additional advantages and features of the present ~~invention~~ disclosure will become apparent from the subsequent description and the appended claims, taken in conjunction with the accompanying drawings, wherein:

**[0019]** Fig. 1 is a longitudinal-section view of a first embodiment of a vehicle wheel bearing apparatus ~~for a wheel of vehicle of the present invention~~;

**[0020]** Fig. 2 is a partially enlarged longitudinal-section view of Fig. 1 showing a wheel bearing;

**[0021]** Fig. 3 is a longitudinal-section view of a second embodiment of the vehicle wheel a bearing apparatus ~~for a wheel of vehicle of the present invention~~; and

**[0022]** Fig. 4 is a longitudinal-section view of a prior art vehicle wheel bearing apparatus ~~for a wheel of vehicle of the prior art~~.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0023]** Preferred embodiments of the present ~~invention~~ disclosure will be described with reference to accompanied drawings.

~~First embodiment~~

~~—[0017]—~~

**[0024]** Fig. 1 is a longitudinal-section view of a first embodiment of a bearing apparatus for a wheel of the present ~~invention~~disclosure, and Fig. 2 is a partially enlarged longitudinal-section view of Fig. 1. In the description of the present ~~invention~~disclosure, a side of a bearing positioned outward ~~aof the~~of the vehicle, when it is mounted on ~~thea~~the vehicle, is referred to as the “outboard” side (the left side in a drawing). ~~A side, and a side inward of thea~~side vehicle is referred to as the “inboard” side (the right side in a drawing).

~~—[0018]—~~

**[0025]** In a vehicle wheel bearing apparatus ~~for a wheel of vehicle~~ of the present ~~invention~~disclosure, a ~~hub-wheel~~wheel hub 1 and a double row rolling bearing 2 are formed as a unit and connected to a ~~driving~~drive shaft “D/S”. The double row rolling bearing 2 ~~includes~~comprises an inner member 3, an outer member 4, and ~~a~~double row rolling elements (tapered rollers) 5 freely rollably contained between the inner and outer members 3 and 4. The inner member 3 includes the ~~hub-wheel~~wheel hub 1 and a pair of inner rings 10 ~~press-fitted~~fit onto the ~~hub-wheel~~wheel hub 1. The ~~hub-wheel~~wheel hub 1 is integrally formed, at its outboard side, with a wheel mounting flange 6. ~~A on which, a wheel “W” and a brake rotor “B” are mounted~~ onto the wheel mounting flange 6. and from which an axially extending cylindrical portion 7 extends from the wheel mounting flange 6. An inner circumferential surface (bore) of the ~~hub-wheel~~wheel hub 1 is integrally formed with a serration (or spline) 8. ~~into which a~~A serrated portion of the ~~driving~~drive shaft “D/S” is inserted into the bore so that ~~a~~torque can be transmitted

~~therebetween~~between the two. ~~A and with~~ a partition wall 9<sub>1</sub> on the outboard side of the ~~hub-wheel~~wheel hub 1, ~~closes for closing~~ a central bore (inner circumferential surface) of the ~~hub-wheel~~wheel hub 1.

~~[0019]~~

[0026] As shown in Fig. 2, the double row rolling bearing 2 ~~comprises~~ includes an outer member 4 formed with double row outer raceway surfaces 4a on its inner circumferential surface. ~~A and with~~ a body mounting flange 4b, formed on an outer circumferential surface of the outer member, is to be secured on an axle housing "H". ~~on its outer circumferential surface, a pair of inner rings 10~~ a pair of inner rings 10 is inserted in the outer member 4. ~~The inner rings 10 are and~~ formed with double row tapered inner raceway surfaces 10a on ~~its~~their outer circumferential surface ~~oppositely~~opposite to the outer raceway surfaces 4a. ~~Double-double row rolling elements 5 are arranged between the inner and outer raceway surfaces 10a, 4a, and a cage 11 for freely rollably holding~~ holds the rolling elements 5. Each of the inner rings 10 is formed with, at its larger diameter end, a large flange 10b ~~for guiding to guide~~ the rolling elements 5. The pair of inner rings 10 ~~are~~is arranged so that their inner ends ~~are abutted~~abut each other and ~~thus form form a~~ so-called a back-abutted type double row tapered roller bearing. Seals 12 ~~are~~ arranged at ~~either~~ ends of the outer member 4 to seal an annular space between the outer member 4 and the inner rings 10. ~~These~~The seals 12 prevent both penetration of rain water or dusts from the external circumstances and leakage of lubricating grease sealed within the bearing. The inboard side seal 12 further prevents penetration or ingress

of differential gear oil into the inside of the bearing passing through the serration 8 of the ~~hub wheel~~wheel hub 1.

~~—[0020]—~~

[0027] The pair of inner rings 10 ~~are~~is press-fitted onto the cylindrical portion 7 of the ~~hub wheel~~wheel hub 1. ~~The inner rings 10 and~~ are prevented from being axially slipped~~slipping~~ off from the cylindrical portion 7 by a caulked portion 13. The caulked portion 13 is formed by plastically deforming the end of the cylindrical portion 7 radially outward. Since this embodiment adopts ~~a~~the self-retaining structure of the second generation, it is not required to control an amount of preload as in a conventional manner by tightly fastening a nut against the inner ring. Accordingly, it is possible to substantially reduce the number of parts and thus to improve the readiness of assembly as well as to reduce its manufacturing cost, size~~weight~~ and weight~~size~~.

~~—[0021]—~~

[0028] The ~~hub wheel~~wheel hub 1 is made of medium carbon steel such as S53C which includes~~including~~ carbon of about 0.40~0.80% by weight. The wheel hub 1 is ~~and~~ hardened by high frequency induction quenching so that the inboard base side of the wheel mounting flange 6 ~~at its inboard side~~ and the cylindrical portion 7 of the ~~hub wheel~~wheel hub 1 have a~~the~~ surface hardness of 58~64 HRC (the hardened portion is shown in the drawings by cross-hatched lines). The caulked portion 13 ~~is remained~~remains as a~~an~~ unhardened portion with~~having~~ its surface hardness of 25 HRC or less. This improves the durability and workability of the caulked portion 13 and also prevents the generation of cracks ~~therein~~.

~~[0022]~~

[0029] The outer member 4 is also made of medium carbon steel such as S53C ~~which including includes~~ carbon of about 0.40~0.80% by weight. ~~The and~~ the double row outer raceway surfaces 4a and ~~the~~ inner circumferential surface of the outer member 4 ~~whereon which~~ the seal 12 is mounted are hardened by high frequency induction quenching so that their surface hardness is within 58~64 HRC. On the other hand, the inner rings 10 ~~is~~are made of high carbon chrome bearing steel such as SUJ2. ~~and~~ The inner rings 10 are hardened to ~~its~~their core by ~~dipping~~dip quenching to have ~~thea~~ surface hardness of HRC 58~64. Although, ~~it~~ the bearing is ~~herein~~ illustrated as a double row tapered roller bearing using tapered roller as ~~the~~ rolling elements 5, ~~a~~ the double row angular ball bearing, using balls, may be also used.

~~[0023]~~

[0030] In this embodiment, since the partition wall 9 is integrally formed at the outboard side on the ~~hub wheel~~wheel hub 1 ~~at its outboard side for closing to close~~ the central bore (inner circumferential surface) of the ~~hub wheel~~wheel hub 1, high rigidity of the ~~hub wheel~~wheel hub 1 can be maintained high even though ~~although~~ it is used in the bearing apparatus of the semi-floating type. ~~Thus, and thus~~ it is possible to suppress an elastic deformation of the ~~hub wheel~~wheel hub 1 ~~although~~even though ~~when the~~ moment load is applied to the ~~hub wheel~~wheel hub 1 during running of ~~thea~~ vehicle. ~~It and also to surely prevent~~prevents ingress of rain water or dusts from the ambient circumstances into the ~~driving~~drive shaft "D/S" and thus into the differential gear oil.

~~Second embodiment~~~~—[0024]—~~

~~[0031]~~ Fig. 3 is a longitudinal-section view of a second embodiment of ~~a~~the ~~vehicle wheel~~ bearing apparatus ~~for a wheel of vehicle~~ of the present invention~~disclosure~~. Since difference of this embodiment from the first embodiment only resides in the structure of the ~~hub-wheel~~wheel hub, ~~the~~ same numerals are used as those used in the first embodiment ~~for designating~~to designate the same structural elements.

~~—[0025]—~~

~~[0032]~~ ~~This~~The vehicle wheel bearing apparatus ~~for a wheel of vehicle~~ is structured as a unit of ~~a~~the hub-wheelwheel hub 14 and a double row rolling bearing 15. The double row rolling bearing 15 ~~comprises~~includes an inner member 16, an outer member 4, and ~~a~~ double row rolling elements 5 and 5 freely rollably contained between the inner and outer members 16 and 4. The inner member 16 includes the ~~hub-wheel~~wheel hub 14. ~~An~~and the inner ~~wheel ring~~ 10 ~~is press-fitted~~fit onto the ~~hub-wheel~~wheel hub 14. The ~~hub-wheel~~wheel hub 14 is integrally formed, at its outboard side, with a wheel mounting flange 6. ~~on which, a~~ wheel (not shown in Fig. 3) is mounted on the flange 6. ~~An~~and with an inner raceway surface 14a ~~is formed on the wheel hub 14 at~~ of the outboard side of the bearing 15. ~~and has the~~The cylindrical portion 7 axially ~~extending~~extends from the inner raceway surface 14a. The ~~hub-wheel~~wheel hub 14 is formed with a serration (or spline) 8 on its inner circumferential surface (bore). ~~with a serration (or spline) 8 into which a~~ serrated portion of the ~~driving~~drive shaft (not shown in Fig. 3) is inserted into the bore to transmit ~~so that a torque can be transmitted therebetween~~between the two, and with

a A partition wall 9<sub>1</sub> on the outboard side of the ~~hub-wheel~~wheel hub 14<sub>1</sub> for ~~closing~~closes a central bore (inner circumferential surface) of the ~~hub-wheel~~wheel hub 14.

~~—[0026]—~~

**[0033]** The outer circumferential surface of the ~~hub-wheel~~wheel hub 14 is formed with a flange portion 14b corresponding to the large flange 10b of the inner ring 10<sub>1</sub>. ~~A and a~~ stepped portion 14c is in the outer circumferential face to abut ~~which an inner end face (smaller end face) of the inner ring 10 abuts.~~ Thus, this provides ~~at the~~ so-called back-abutted type double row tapered roller bearing is ~~structured~~structure. In addition, the inner ring 10 is press-fitted ~~fit~~ onto the cylindrical portion 7 of the ~~hub-wheel~~wheel hub 14. The inner ring 10 ~~and~~ is prevented from ~~being axially slipped~~slipping off ~~from~~ the cylindrical portion 7 by a caulked portion 13. The caulked portion 13 is formed by plastically deforming the end of the cylindrical portion 7 radially outward. Since this embodiment adopts ~~at the~~ self-retaining structure of ~~such a~~ third generation, it is not required to control an amount of preload as in a manner similar to the first embodiment by tightly fastening a nut against the inner ring. Accordingly, it is possible to improve the readiness of assembly as well as to maintain the amount of preload for a long term.

~~—[0027]—~~

**[0034]** Since the inner raceway surface 14a is directly formed on the outer circumferential surface of the ~~hub-wheel~~wheel hub 14 and the partition wall 9 is also integrally formed on the ~~hub-wheel~~wheel hub 14 at its outboard side ~~end~~, the rigidity of the ~~hub-wheel~~wheel hub 14 is increased. Accordingly, it is possible to suppress an

elastic deformation of the ~~hub-wheel~~wheel hub 14 ~~although~~even though the moment load is applied to the ~~hub-wheel~~wheel hub 14 during running of ~~the~~a vehicle. Also, it ~~and also to surely prevent~~prevents ingress of rain water or dusts from the ambient circumstances into the ~~driving~~drive shaft "D/S" and thus into the differential gear oil.

~~Applicability in industry~~

~~[0028]~~

[0035] The present vehicle wheel bearing apparatus ~~for a wheel of vehicle of~~ the present invention can be applied to a bearing apparatus for a wheel of a vehicle of the driving wheel side of the semi-floating type ~~in which~~where a wheel bearing is arranged in opened portions between a ~~driving~~drive shaft and ~~an~~a axle housing.

[0036] ~~[0029]~~ The present ~~invention~~disclosure has been described with reference to the preferred embodiment. Obviously, modifications and alternations will occur to those of ordinary skill in the art upon reading and understanding the preceding detailed description. It is intended that the present ~~invention~~disclosure be construed ~~as including~~to include all such alternations and modifications insofar as they come within the scope of the appended claims or ~~the~~their equivalents ~~thereof~~.



## WHAT IS CLAIMED IS:

\_\_\_\_\_—1. A vehicle wheel bearing apparatus ~~for a wheel of vehicle~~ structured as a unit of a ~~hub wheel~~wheel hub (1, 14) and a double row rolling bearing (2, 15) comprising:

\_\_\_\_\_—an inner member (3, 16) including a ~~hub wheel~~wheel hub (1, 14) integrally formed with a wheel mounting flange on its one end, ~~with a wheel mounting flange (6) and on its~~an inner circumferential surface of the wheel hub is formed with a serration, (8) ~~and having an axially extending cylindrical portion~~ with a pair of inner raceway surfaces extend from the flange (7);

\_\_\_\_\_ ~~and one or more inner rings (10) rings being press-fitted~~fit onto the cylindrical portion (7) of the ~~hub wheel~~wheel hub, the one or more inner rings are formed with at least one of the inner raceway surfaces (1, 14) and formed on its~~which~~ outer circumferential surface ~~with at least one of inner raceway surfaces (10a);~~

\_\_\_\_\_—an outer member (4)is arranged around the inner member, the outer member is (3, 16) and formed with double row outer raceway surfaces (4a) on its inner circumferential surface ~~oppositely~~opposite to the inner raceway surfaces (10a);

\_\_\_\_\_—double row rolling elements (5) are arranged between the inner and outer raceway surfaces (10a, 4a) of the inner member (3, 16) and the outer member (4);

\_\_\_\_\_—a cage (11) ~~for freely rollably holding~~holds the rolling elements (5);  
and

\_\_\_\_\_—seals (12) ~~for sealing~~seal an annular space between the inner member (3, 16) and the outer member (4); and

\_\_\_\_\_—characterized in that a partition wall (9) is integrally formed on the ~~hub wheel~~wheel hub (1, 14) at its outboard side ~~for closing~~to close a central bore of the ~~hub wheel~~wheel hub (1, 14).

\_\_\_\_\_—2. ~~A~~The vehicle wheel bearing apparatus ~~for a wheel of vehicle~~ of claim 1 wherein ~~said~~ at least one (14a) of said inner raceway surfaces (10a) is formed directly on the outer circumferential surface of the ~~hub wheel~~wheel hub (1, 14).

\_\_\_\_\_—3. ~~A~~The vehicle wheel bearing apparatus ~~for a wheel of vehicle~~ of claim 1 wherein the end of said cylindrical portion (7) is plastically deformed radially outward to form a caulked portion (13) ~~for preventing the inner ring (10) from being slipped~~slipping off ~~offrom~~ the cylindrical portion (7) of the ~~hub wheel~~wheel hub (1, 14).

\_\_\_\_\_—4. ~~A~~The vehicle wheel bearing apparatus ~~for a wheel of vehicle~~ of claim 3 wherein ~~the an~~ outer circumferential region of the wheel mounting flange (6) ~~from its base of an~~ inboard side base side to the axially extending cylindrical portion (7) is hardened by high frequency induction hardening ~~to as having~~ have ~~the a~~ surface hardness of about 58~64 HRC, and the caulked portion (13) ~~is remained~~remains unhardened ~~as having to have~~ at the surface hardness of 25 HRC or less after forging.

\_\_\_\_—5. ~~The A vehicle wheel~~ bearing apparatus for a wheel of vehicle of a semi-floating type comprising an axle housing “H” supported under a body of a vehicle; a hollow ~~drivingdrive~~ shaft “D/S” inserted into the axle housing “H”; and the ~~vehicle wheel~~ bearing apparatus for a wheel of vehicle of claim 1 arranged between the ~~drivingdrive~~ shaft “D/S” and an opening of the axle housing “H”; and the ~~drivingdrive~~ shaft “D/S” is connected to said inner member (3, 16) so that a torque is transmittable ~~therebetween~~ between the two.

\_\_\_\_—6. ~~A~~ The vehicle wheel bearing apparatus for a wheel of vehicle of a semi-floating type of claim 5 wherein the ~~drivingdrive~~ shaft “D/S” is separably connected to the inner member (3, 16) via the serration.

## ABSTRACT OF DISCLOSURE

~~\_\_\_\_\_~~—An object of the present invention is to provide ~~a~~ A vehicle wheel bearing apparatus ~~for a wheel of vehicle which can reduce~~ reduces the weight, size and a number of parts ~~and also can prevent~~ prevents ingress of rain water or dusts and leakage of differential gear oil. According to the present invention there is provided a bearing apparatus ~~for a wheel of vehicle~~ is structured as a unit ~~with~~ of a hub ~~wheel~~ wheel hub (1, 14) and a double row rolling bearing (2, 15). ~~\_\_\_\_\_ comprising an~~ An inner member (3, 16) ~~including~~ includes ~~at the hub wheel~~ the hub wheel hub (1, 14) integrally formed with a wheel mounting flange (6) on its one end. ~~\_\_\_\_\_ with a wheel mounting flange (6) and on its~~ The wheel hub inner circumferential surface ~~with~~ includes a serration (8). ~~An and having an~~ axially extending cylindrical portion (7) extends from the flange (6). One or more and inner inner rings (10) are press-fitted fit onto the cylindrical portion (7) of the ~~hub wheel~~ wheel hub (1, 14). The inner rings are ~~and~~ formed on ~~which~~ their outer circumferential surface with at least one of the inner raceway surfaces (10a); ~~\_\_\_\_\_ an~~ An outer member (4) is arranged around the inner member (3, 16). The outer member (4) is ~~and~~ formed with double row outer raceway surfaces (4a) on its inner circumferential surface ~~oppositely~~ opposite to the inner raceway surfaces (10a). ~~Double;~~ double row rolling elements (5) are arranged between the inner and outer raceway surfaces (10a, 4a) of the inner member (3, 16) and the outer member (4); ~~\_\_\_\_\_ A~~ a cage (11) ~~for freely rollably holding~~ holds the rolling elements (5). ~~Seals; and seals (12) for sealing~~ seal an annular space between the inner member (3, 16) and the outer member (4). ~~A characterized in that~~ a partition wall (9) is integrally formed on the ~~hub wheel~~ wheel hub (1, 14), at its outboard side, ~~for to close~~ closing a central bore of the ~~hub wheel~~ wheel hub (1, 14).